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STRATEGIES AND POLICIES FOR THE DEVELOPMENT OF THE BUILDING MATERIALS INDUSTRY IN DEVELOPING COUNTRIES

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I. CONCEPTUAL AND DEFINITIONAL CONSIDERATIONS

1. The building materials industry is generally understood to embrace a wide range of disparate industrial activities for the production of materials that are permanently or temporarily incorporated in construction. The industrial sectors encompassed include agro industry (wood, fibres), metal industry (iron and steel, non-ferrous metals), non-metallic minerals (cement, glass, ceramics, clay products), chemicals (plastics, rubbers, fibres and paints) and engineering (fittings and furnishing). The activities cover primary extraction and processing at one end of the spectrum through manufacturing to fabrication of parts and components at the other. Furthermore, the products originate from a variety of natural resources and intermediate products, the end-uses of which might be equally significant to sectors other than construction. The building materials industry is presumed to exclude activities which are generally considered to form part of the construction industry such as transport to site, cutting, bending, mixing etc. on site to cast the materials to the desired or specified state of finalization. However, the dividing line between the building materials and construction industry is not hard and fast. The trend towards greater industrialization of the construction process through such methods as precasting, prefabricating, modular co-ordination etc. has further blurred the distinction.

2. There are, therefore conceptual and definitional issues that need to be addressed at the outset in order to establish the analytical framework for strategy and policy formulations that are specific to the sub-sector. There are alternative ways of meeting the objective. One approach for grouping building materials for purposes of analyses and policy discussions could be by type of materials used. Such a grouping would include (a) stone, clay, sand and gravel; (b) non-metallic minerals (cement, glass, gypsum); (c) wood-based building materials; (d) metallic building materials; and (e) building materials of chemical origin including new materials.

3. The search for practical solutions to overcome the constraints faced by the building materials sub-sector would be greatly facilitated were the Consultation to address a narrower and more focussed range of products. Consequently, the approach that could go some way to meeting this objective is one that takes into account (a) the preponderance in and criticality of certain products to the construction industry; (b) their potential for reducing construction costs through improvement of productivity and expansion of domestic production; (c) the promotion of increased local content in their production; (d) the prospects of improved and cost-effective use of new and substitute materials; (e) their suitability for production on a small-scale in accordance with prevailing market size, and (f) the applicability and efficiency in alternative construction techniques.

4. In light of the above criteria, the Consultation could usefully centre its deliberations on the manufacture of those building materials which are considered as basic inputs to the construction industry: cement, clay products, wood, iron and steel, sheet glass, and thermoplastics. Consequently, the ensuing analysis is addressed primarily to these materials without, at the same time losing sight of the broader context in which their development takes place including the introduction of new materials through such processes as recycling.

II. DEMAND-SUPPLY GAP

5. The sources of demand for building and construction materials can be taken according to the type of structure, whether housing, public and commercial buildings or infrastructure. The need for housing and other construction is immense in order to accommodate population growth by the year 2000 and beyond. The increasing urbanization in developing countries also puts pressure on the need for more housing and social buildings. As the developing countries industrialize, infrastructure requirements for bridges, roads, dams, and harbours increase at an accelerating rate. Thus the demand for building materials is dependent on the volume of construction activity which in turn is correlated with overall economic performance. In the 1970's the growth of the construction industry in developing countries tended to exceed overall economic growth while in the 1980's many countries, particularly in Latin America, stagnated with resulting declines in the growth rate construction.

6. The cyclical activity of the construction industry helps to explain the fluctuations in demand and the resulting gap in supply. In construction booms the demand increases faster than the domestic building industry can produce the required products. Imports, therefore, are necessary to fill the gap. In recessionary periods, the effective demand for building materials is reduced and the industry has underutilized capacity.

7. In 1985, the share of developing countries in the production of all types of building materials was 16.7 per cent while she share of imports for all types of building material was 30.8 per cent. Exports accounted for only 10.4 per cent for the same year. When taken separately by type of material, the percentages were much higher. Imports of chemical products for instance were the highest, being 53.1 per cent of value of consumption. Regional differences are evident with West Asia being dependent on imports for 46.5 per cent of its finished metal product needs. Tropical Africa had the highest import propensity for both chemical products as well as wood products, 89 per cent and 51.6 percent respectively. There were also large imports of primary as well as finished metal products. As expected, minimally processed mineral products which consist of stone, sand, gravel, etc. had lowest share of imports in both regions at only 1.5 per cent in tropical Africa and 1.9 per cent in West Asia.1/

III. DEMAND SIDE CONSTRAINTS

3.1. Markets

8. The large gap in the developing countries between demand and supply of the basic materials observed in Section II suggests at first sight that the development of the sub-sector is not constrained by the level of aggregate demand. The figures, however, conceal wide disparities in levels and patterns of demand between countries and even within individual countries. There are countries where domestic demand is largely met by domestic supply. However, the large majority of countries are dependent on imports to meet demand, particularly of the main basic materials, namely cement, wood, and iron and steel. On the whole, it is estimated that 40-60% of the consumption of building materials is met by imports.2/

1/ The Building Materials Industry: The sector in figures, Sectoral Studies Series No. 16 Volume II - UNIDO/IS.512/Add.1, 3 October 1985, pp. 15 and 74.

2/ G.A. Edmonds and D.W.J. Miles, Foundation for Change, Intermediate Technology Publication 1984, p.13

9. The small size of markets, their fragmentation and dispersal over wide geographic areas in the majority of developing countries have acted as obstacles to the establishment of manufacturing units which accord with the exigencies of economies of scale. Policies and institutional support measures have generally not been effective in influencing patterns of domestic demand and in consolidating markets through instruments such as regional co-operation. The choice of materials is largely determined by engineers and architects who naturally tend towards the use of state-of-the-arts technology in construction techniques and materials. Consequently, there is a built-in bias against the intensive use of local materials or materials with local content. Skepticism also deters the introduction of new materials particularly of substitute materials which are based on agricultural waste or industrial by-products. Consumer preferences also play a significant role in determining patterns and levels of demand. For example, it is commonly recognized that in some countries wooden housing is not favourably looked upon in spite of its cost-effectiveness. Policies and promotional measures are either deficient or non-existent in many countries with respect to (a) eliminating built-in biases and misconceptions; (b) increasing the local content in the manufacture of building-materials; (c) assessing cost-benefits as a guide for choice of materials particularly substitute materials; (d) consolidating markets to assure economic viability; and (e) giving the right and timely signals to investors for the setting-up of new productive capacities.

3.2. Economies of scale

10. Economies of scale have been one of the determinant factors that has impeded the development in the developing countries of basic materials such as cement and iron and steel as well as other materials such as sheet glass, plywood, fibreboard and particle board and intermediate petrochemical products needed for the manufacture of plastics. Hand-in-hand with policies of market consolidation to increase effective demand, efforts have been directed to the search of technologies which would permit production for small markets. This had led to the notion of "minis" i.e. down-scaling of technologies. In the case of cement, the viability of verticle shaft kilns with installed capacity of as little as 20,000 tons annually has been established through pilot projects.3/ There is still need, however, of continued research to reduce production costs. As in the case of cement, the viability of mini iron and steel plants has been analyzed by a number of UNIDO studies as well as by technical assistance projects.4/ Advances in technology such as cold casting and the reduction process have been instrumental in lowering the level of production concomitant with economic efficiency and resulted in a number of developing countries expanding their own iron and steel industries.5/ The overall conclusion to be drawn from recent successes is that a concerted effort of R&D could offer dividends in terms of reconciling the prevailing dichotomy of market size and notions of economies of scale.

3/ Fred Moavenzadeh, Measures and actions to increase the production of indigenous building materials in the context of enhanced import substitution UNIDO (ID/WG/425/3, 17 August 1984).

4/ S. Samaragpungauan, Integrated development of the steel industry particularly mini steel, linked to capital goods and agricultural machinery UNIDO, ID/WG/458/7, 9 December 1985.

5/ Ibid

11. Considerations of economies of scale are on the other hand less critical for a wide range of secondary building materials, i.e. products derived from basic materials: bricks, clay products, concrete products, timber joinery and structures, fabricated metals, plastics etc. Most are bulk materials and thus costly to transport. Their locations on the whole are predicated by proximity to markets. While the public sector and foreign investors generally predominate the operations of basic materials industries for financial and technological reasons, the secondary building materials industry is eminently suited to small and medium private sector initiatives. Consequently these industries could act as entry points to industrialization and as instruments of decentralization and diversification of the process in the developing countries through the pursuance of policy and promotional measures aimed at entrepreneurial development and optimal utilization of local resources.

12. Furthermore, technological innovations could widen the market for such entrepreneurs. In particular, construction techniques such as prefabrication and modular co-ordination could give rise to profitable ventures in the production of building parts and components in concrete, timber and metals. Ready-made concrete and pre-prepared reinforcing rods are further aspects of a strategic convergence of the building materials and construction industries favouring increased opportunities for small-scale enterprises. Simplication of technologies and equipment could also widen the market for building materials to meet unsatisfied demand particularly in rural areas, e.g. mobile machines for making bricks, cement and soil-cement blocks, culverts and drainage tubes, etc. The discovery and exploitation of hidden opportunities are, however, hampered by lack of information and institutional support to appraise, select and adapt technologies, to assess markets, and to conduct the requisite feasibility studies.

3.3 Production costs

13. Encouraged by buoyant demand, industries were set-up in developing countries under regimes of tariff protection. Examples of countries which achieved international competitiveness through an import-substitution strategy are far less common than those which did not. This is particularly true of iron and steel and sheet glass and less so in the case of cement and wood-based products. One of the main reasons for high production costs is the high capital-output ratios which prevail in developing countries. Costs of capital goods are considerably higher than in industrialized countries. Consequently the high investment costs per unit of output keep production costs elevated. Backward integration aimed at the production of capital goods has generally received scant attention in the majority of the developing countries.

14. Other cost elements are no less critical. The building materials industry is energy-intensive and therefore costs are sensitive to the price of energy inputs as well as to stability of supply as frequent breakdowns add to costs of production. Uncertainties in the supply of raw materials and imported intermediate inputs lead to stoppages and thus costly under-utilization of installed capacities. The mounting debt burden has compounded the difficulties of maintaining capital stock as investments for retooling and rehabilitation have been declining dramatically in recent years. Repair and maintenance systems are inadequate, particularly for the secondary building materials industries. They moreover suffer from a lack of provision of spare parts and common service facilities. Productivity is generally low in the developing countries compared with the industrialized countries. It may be the result of any or a combination of various factors: choice of technology,

labour skills, organization and managerial abilities, stability of input supplies, preventive maintenance, incentives etc. The long-term viability and profitability of the sub-sector is quite clearly critically dependent on productivity improvements.

15. Prices to end-users under conditions of high production costs as outlined above and transportation costs which for bulky materials are also high have significant implications on the achievement of national economic and social objectives. Building materials account for about 40-50% of construction costs 6/. Therefore, the reduction of construction costs is primarily dependent on the productivity and competitiveness of the building materials industry. The rising demand for physical infrastructures, building and social housing would remain unfulfilled in the absence of coherent and co-ordinated efforts directed to raising the productivity of the building materials industry.

IV. SUPPLY SIDE CONSTRAINTS

4.1 Raw material supply

16. There is no dearth of raw material availability in the developing countries as a whole for the production of basic building materials. As a group they are major producers of timber and minerals such as iron ore, bauxite and other non-ferrous ores. They have also built up capacity for primary processing, smelting and refining. Significant thrusts have also been made in the manufacture of semi-finished and finished products. Suitable deposits of clay, limestone, gypsum and sand are also available for the manufacture of bricks, cement, sheet glass etc. There are, however, striking differences in resource endowments among countries. There are surplus and deficit countries in the supply of raw materials which suggests a prima facie case for South-South co-operation in production and trade. Public policy statements in developing countries have long extolled the need of regional co-operation for the optimum and mutually beneficial exploitation of their natural resources but these have yet to be translated into concrete actions. Private sector initiatives could give a much-needed impulse in this respect and the recent steps taken by Latin American countries to promote and implement complementarity projects for the production of semi-finished and finished products in the non-ferrous sector are encouraging. 7/

17. With regard to secondary building materials the issues present themselves in a somewhat different light. These are dependent on the supply of intermediate products of domestic or foreign origin. Prices at which these are supplied determine their long-term viability in the face of competition from substitute or new materials. As firms engaged in these activities do not as a rule generate foreign exchange, market signals might prove inadequate for the allocation of resources. They would need to be backed by public policy measures to assure the predictability of supplies and to promote the optimum use of basic materials locally available and in which the country enjoys comparative advantage.

6/ C.A. Edmonds and D.W.J. Miles, Op. cit, p.13

7/ Max Moya Bedenzo, The development of non ferrous metals in South America and the possibilities for complementarities, UNIDO, ID/WG.481/3 (SPEC) 5 January 1989

4.2. Technology and skills

18. The lack of capacities for the choice, transfer and adaptation of technology is as much a constraint on the development of the building materials industry as it is in other industrial sub-sectors. Advances have been made as noted earlier in down-scaling technologies to enable manufacturing in small-scale plants. Developing countries by-and-large lack the skills and institutional capacities to absorb these advances and adapt them to their own specific requirements and factor of production endowments. Prevailing educational and training programmes often fail to produce the technologists, researchers, managers and operatives which could effectively undertake the challenging task of technological innovation. Consequently, the majority of the developing countries continue to be passive participants in the industrialization process.

19. Technological innovation is a product of collective effort whereby the expertise and experiences of a multi-disciplinary team are made to bear upon the resolution of technological problems on a sustained basis. The mechanisms for pooling these resources are lacking; as are the institutional support measures. They are the critical ingredients of technical progress which technological policy should address to assure the sustainable growth of the building materials industry. Several countries have established building research institutions which have carried out valuable work but the results have, by-and-large, not been translated into investment projects on account of the non-involvement of potential end-users in the research work.

4.3. Entrepreneurship

20. The building materials industry and particularly its secondary materials component provide potential routes of entry for domestic entrepreneurship. The manufacture of materials derived from clay products, cement, metals, wood and plastics for roofing, walling, flooring, etc. gives rise to a variety of small-scale activities. These opportunities, however, are not fully exploited in many developing countries on account of lack of policy and support measures conducive to entrepreneurship development on the one hand and the skepticism or lack of grasp of opportunities on the part of potential investors on the other. The latter might frequently be due to misplaced conceptions of risk as compared to returns on alternative investments usually in the non-productive sectors. The lack of readily available information on markets, technology and sources of financing is a further impediment to the entry of new entrepreneurs. On the other hand, those enterprises which are already established might perceive that the support services that they receive from the public authorities in terms of extension services, common service facilities, access to credits, and allocation of foreign exchange resources are inadequate.

4.4. Finance

21. The magnitude of the current and anticipated shortfalls in the supply of building materials observed in Section II poses a formidable challenge of financing the rehabilitation of installed manufacturing units and the establishment of new ones. The financing of building materials is inextricably linked to the financing of projects of physical and social infrastructures, building and housing. It falls upon Governments to raise the necessary funds for their priority projects from domestic and external sources. Developing countries presently face increasing difficulties in raising external funding on account of their indebtedness problem. External aid and loans which stipulate the importation of building materials would not obviously stimulate the domestic building materials industry. Tied aid is not

in the best interest of the developing countries in that they miss the opportunity of expanding their building materials industry concurrently with meeting their pressing needs for economic and social infrastructures.

22. Financing has been and continues to be a critical constraint on the development of the building materials industry. For that reason, policies should ensure that the industry is enabled to secure the necessary funds to prepare itself to supply the inputs for investments in physical infrastructures and social overheads through (a) ready access to credits; (b) allocating to the building materials sub-sector of a share of the aid and/or loans for construction; and (c) mobilization of domestic resources by means of publicizing of investment.

23. The financing needs of small enterprises present special problems in terms of access to credits and collaterals. These are issues common to all small enterprises, whatever the sector. In regard to building materials, a case for special treatment could be made in the context of well-established programmes for the construction of physical infrastructures and housing. These should make access to credits easier, provided entrepreneurs put forward plausible plans for upgrading or expanding of their operations.

4.5. Institutional support measures

24. The building materials industry is subject to a variety of controls under building by-laws, codes and standards which determine the acceptability of the material to engineers and architects and to the end-user. These could be stringent to an extent as to deter or force entrepreneurs out of business. Developing countries have, by-and-large, adopted the practices of the industrialized countries with minor changes. Designers tend to be more readily influenced by construction practices in industrialized countries rather than of those of the developing countries. Consequently the use of substitute or new materials might be discouraged in favour of materials the characteristics of which are more extensively described in building codes.

25. There is a need for a major reorientation of the services of building research institutions, public housing authorities and municipalities so as to foster a greater receptivity of innovations in established practices and procedures and in encouraging enhanced local content of building materials. There is an evident lack of exchange of information among developing countries in the application of building codes, in the use of research results and in the introduction of new materials and construction techniques to reduce costs of providing housing for low-income groups. The absence in the majority of developing countries of checklists, guidelines and manuals on the characteristics and use of building materials acts as an impediment for new investments as well as reinvestments in existing productive capacities.

V. FINAL CONSIDERATIONS

26. In the light of the constraints outlined above, the Consultation may wish to highlight the key components of strategies and policies that balance the interest of all parties concerned and thus lay a sound foundation for the sustained growth of the building materials industries. To respond effectively to the preoccupations outlined earlier, major changes in policies and institutions may need to be introduced and applied in accordance with the specific needs of individual or groups of developing countries. The formulation and pursuance of national measures would need to take into full account the opportunities offered by international co-operation: regional, South-South and North-South. In the search for solutions that are concrete

and feasible, the Consultation may consider it appropriate to focus its deliberations on the following key aspects of demand and supply that shape strategy and policy formulations.

27. Long-term assessment of demand for all kinds of construction as well as the building materials required needs to be carried out regularly to establish how anticipated shortfalls can be met through domestic production and or imports over time and their implications for the allocation of resources and the formulation of policies. It may be advisable to entrust the task to a central body in Government structures in co-operation with manufacturing and professional associations and the construction sector.

28. Wide fluctuations in construction activities introduce uncertainties in the building materials industry thus denying it a stable market for its products. The predominance of small and fragmented markets also acts as a disincentive for domestic production. Furthermore, there is an unsatisfied demand for building materials caused by various reasons such as high costs of production, regulatory measures that discourage the use of lesser-known substitute materials or new materials, transport costs, energy conservation measures, environmental hazards, etc. Concerted efforts are needed to (a) stabilize the pace and level of construction investments and avoid wide fluctuations which adversely affect the objective of the sustained growth of the building materials sub-sector; (b) promote regional co-operation for widening markets; (c) provide policy guidelines to facilitate the choice and acceptability of competing building measures; (d) adapt building codes to the specific needs of the concerned countries; and (e) institute promotional support measures for locating building materials industries in rural areas.

29. On the supply side, the availability of raw materials determines the possibilities of import-substitution and/or export promotion. The typical situation is that there are resource-surplus countries side-by-side with resource-deficit countries which again opens up opportunities for regional and South-South co-operation. Surveys of raw materials in developing countries would facilitate information on resource availability by country and region. Advances in technology also create opportunities for international co-operation in down-scaling technologies, adapting them to the specific needs of the developing countries and in promoting technological innovations along a broad front. There is also wide scope for co-operation in training manpower at all levels and to develop national capacities for the choice, transfer and development of technology. Related to these are measures aimed at developing entrepreneurship for which the building materials industry is well-suited as a point of entry. With regard to financing, the prospects of the building materials industry is inextricably linked to financing of construction, building and housing. There is a need, however, to separate aid and loan packages from the supply of materials through imports so that these could be utilized for stimulating the domestic building materials industry. Finance is also needed for rehabilitating existing capacities, improving productivity and lowering production costs.

30. There is also a great need for establishing and strengthening institutional support mechanisms through international co-operation and specifically through exchange of information and experiences on technology, markets and research results. The long-term viability of existing and new capacities require measures aimed at (a) reducing investment costs through, inter-alia, domestic manufacturing of capital goods; (b) energy conservation; (c) assured and predictable supplies of raw materials and intermediates;

(d) improvement of managerial and organizational capacities; (e) maintenance and spare parts production; (f) quality control and standardization measures; and (g) close interaction of industry with building research institutes and decision makers. Lastly the role of professionals (architects and engineers) in introducing innovations and in adapting construction techniques to the specific needs and resource endowments of developing countries is crucial to the objective of raising the productivity of the construction industry.

31. In conclusion, while strategy and policy formulations are by their very nature country-specific, there are common concerns and preoccupations in the developing countries which need to be addressed to promote the sustained development of the building materials industry. Some areas of strategy and policy thrusts include:

(i) The integration of the building materials industry with other productive sectors through such means as forward planning of investments in resource-based and related industries and a deliberate policy of encouraging closer inter-action among the main actors in the manufacturing and construction industries; namely planners, policy makers, bankers, manufacturing and professional associations, technologists, researchers etc.

(ii) The stimulation of effective demand by means of lower and affordable prices of building materials through reduction of production costs, introduction of energy-saving techniques and decentralization of the manufacture especially of bulk secondary materials to consumption centres thus saving on transport costs. Clay and cement-based products as well as a range of wood products and plastics are especially suited to a decentralization strategy.

(iii) The promotion of regional co-operation to widen the market for basic building materials, namely cement, iron and steel, non-ferrous metals, sheet glass and plywood and veneers as the strategy could bring about substantive reduction in construction costs through the effective exploitation of economies of scale.

(iv) The encouragement of construction techniques that foster full utilization of the factor endowments of the developing countries, make maximum use of local materials and at the same time permit mass production of parts and components especially aimed at the provision of housing to lower-income groups. Cement, iron and steel, wood and thermoplastics play a crucial role in mass production strategies.

(v) The systematic survey and exploration of natural resources and updating of inventories to sustain the assured supply of raw-materials to the building materials industry and thus stimulate investments in new production facilities and reinvestments in existing ones.

(vi) The intensification of efforts to promote the efficient and effective transfer and development of technology through instruments such as international co-operation in scaling down technologies, setting-up and operating pilot demonstration plants to assess viability and profitability, exchange of information and experiences etc. on the one hand, and on the other to undertake measures aimed at the development of indigenous skills and capabilities to adopt, innovate and improve technologies.

(vii) The purposive search for new or alternate materials aimed at reducing construction costs through increased and intensive use of local materials and/or cheaper sourcing of intermediates such as plastics for walling, roofing, flooring, piping, drainage and joinery. There is wide scope for manufacturing secondary products that can be derived from cement, timber, plastics, agricultural waste and recycling while at the same time safeguarding the environment. There is a need for institutional support measures for cost comparisons and for policy guidance that could stimulate investments. Equally important for cost-reduction strategies is the strengthening of R&D efforts of building research institutions and their effective inter-action with end-users.

(viii) The promotion of production complementarities in the industry. There is a great need to reinforce the linkages between the formal and the informal sectors of production of building materials. Institutional support and guidance will be needed in the identification and selection of the most appropriate materials to be produced in accordance with market needs and on a country-to-country basis.

(ix) The development of private sector indigenous entrepreneurship as the building materials industry and especially the production of secondary materials is well-suited for small- and medium-size manufacturing. Promotional and support measures are, however, essential to assist prospective investors in identifying and evaluating investment opportunities and provide them with a range of extension services to ensure viability and profitability.

(x) The rehabilitation of existing plants to bring about full utilization of installed capacities, raise productivity and reduce production costs. To be effective, however, rehabilitation programmes would need to be conceived and carried out in the context of restructuring objectives and macro-economic adjustments.

(xi) The mobilization of domestic and external financial resources through suitably designed and coherent monetary and fiscal policies and promotional measures to create an environment conducive to investments in the building materials industry. The long-term planning of public investment opportunities could act as a stimulant for mobilizing financial resources. The creation of financial instruments to facilitate easy access to credits constitutes a potent means for increased participation of the private sector in the development of the sub-sector. International co-operation could play a key role in the achievement of this objective involving in particular the domestic and international financial institutions and donor countries.

(xii) The need for quality control in the production of building materials to ensure acceptability in design and durability in use through capacity building in research, testing, standardization and enactment of building codes that are appropriate and responsive to specific local needs are critical components of a strategy of optimum utilization of local building materials and reduction of construction costs. The preparation of manuals, guidelines etc. is one way of fostering common approaches to construction techniques and use of materials.

(xiii) The safeguarding of the environment against degradation of the eco-system arising out of the exploitation of natural resources for building materials such as wood products, plastics etc. is a prerequisite for the orderly development of a sub-sector that is intended, inter-alia, to alleviate social problems and not to aggravate them.